

US EPA ARCHIVE DOCUMENT

June 25, 2014

Mr. Todd Campbell  
Federal On-Scene Coordinator  
U.S. Environmental Protection Agency, Region 7  
11201 Renner Boulevard  
Lenexa, Kansas 66219

**Subject Preliminary Pre-CERCLIS Screening Report**  
**Bridgeton Municipal Athletic Complex, Bridgeton, Missouri**  
**U.S. EPA Region 7 START 4, Contract No. EP-S7-13-06, Task Order No. 0002.023**  
**Task Monitor: Todd Campbell, On-Scene Coordinator**

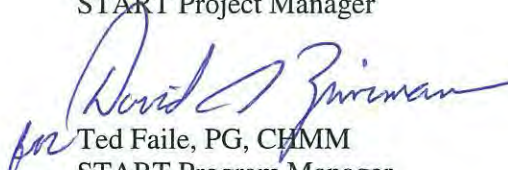
Dear Mr. Campbell:

Tetra Tech, Inc. is submitting the attached Preliminary Pre-Comprehensive Environmental Response, Compensation, and Liability Information System (Pre-CERCLIS) Screening Report regarding the Bridgeton Municipal Athletic Complex (BMAC) in Bridgeton, Missouri. If you have any questions or comments, please contact the project manager at (816) 412-1785.

Sincerely,



Colin Willits  
START Project Manager



Ted Faile, PG, CHMM  
START Program Manager

Enclosures

**PRELIMINARY PRE-CERCLIS SCREENING REPORT**

**BRIDGETON MUNICIPAL ATHLETIC COMPLEX  
BRIDGETON, MISSOURI**

**Superfund Technical Assessment and Response Team (START) 4 Contract  
Contract No. EP-S7-13-06, Task Order 0002.023**

Prepared For:

U.S. Environmental Protection Agency  
Region 7  
Superfund Division  
11201 Renner Boulevard  
Lenexa, Kansas 66219

June 25, 2014

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## 1.0 INTRODUCTION

The Tetra Tech, Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) was tasked by the U.S. Environmental Protection Agency (EPA) Region 7 Superfund Division to assist with a Pre-Comprehensive Environmental Response, Compensation, and Liability Information System (Pre-CERCLIS) Screening at the Bridgeton Municipal Athletic Complex (BMAC) in Bridgeton, Missouri. The Pre-CERCLIS Screening was conducted to determine if further Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response would be warranted. The screening activity was in response to a request by the Missouri Attorney General to the EPA Regional Administrator after a community group conducted field screening of soil at BMAC and reported detection of elevated radiation readings.

Tetra Tech's tasks included, but were not limited to: (1) acquisition of real-time gross gamma measurements of exterior surfaces at BMAC and reference areas, (2) assessment of gross gamma survey results to help select sampling locations, (3) collection of discrete and composite soil samples from BMAC and reference areas for laboratory analysis, (4) collection of discrete soil samples for laboratory analysis collocated with samples collected by the community group, and (5) documentation of site activities. This Preliminary Pre-CERCLIS Screening Report presents the real-time gross gamma activity measurements of exterior surface areas of BMAC and reference areas. Following receipt of laboratory analytical data, a final report will address soil sampling activities and analytical data.

Colin Willits was the START project manager for the investigation, and the EPA Region 7 On-Scene Coordinator (OSC) was Todd Campbell.

## **2.0 SITE DESCRIPTION AND BACKGROUND**

Section 2.0 provides information on the site location and description, and site background.

### **2.1 SITE LOCATION AND DESCRIPTION**

The BMAC site is at 13161 Taussig Road in Bridgeton, Missouri. The Global Positioning System (GPS) coordinates of the approximate center of the site are 38.779422 degrees (°) north latitude and 90.428224° west longitude. The site encompasses approximately 70 acres, including 11 baseball fields, four tennis courts, a playground area, a handball/racquetball court, a soccer field, multiple walking trails, two large parking lots, multiple concession buildings, an operation center, and other various structures (see Appendix A, Figures 1 and 2).

Two parks, Koch and Blanchette, were selected for acquisition of reference data during the Pre-CERCLIS Screening. These parks were selected for reference areas because they contain surface types similar to those at BMAC (including baseball fields with grass-covered and exposed soil areas). Koch Park is 4.1 miles northeast of BMAC near the intersection of Charbonier and Howdershell Roads in Florissant, Missouri. The park encompasses 70 acres and includes several baseball fields. Blanchette Park is 3.3 miles west-northwest of BMAC at 1900 West Randolph Road in St. Charles, Missouri. The park encompasses 44 acres, including several baseball fields (see Appendix A, Figure 1). The two reference areas provide contrasting positions from BMAC relative to prevailing wind directions—that is, Koch park is generally cross- to downwind of BMAC and Blanchette park is generally upwind of BMAC given the predominant prevailing winds in the area out of the south and west.

### **2.2 SITE BACKGROUND**

BMAC opened in 1974, encompassing 30 acres including six baseball fields, four tennis courts, four racquetball courts, a concession building, a pavilion, and a park maintenance facility. During the mid-1980s, four batting cages were installed on the south side of the complex. The batting cages were removed in 2007. In 1999, the City of Bridgeton began a phased expansion of BMAC. The 10-year expansion project added five baseball fields (2001-2003), a new park maintenance facility (2002), expanded north parking lot (2003-2004), one additional concession building (2004-2005), one soccer field (2005), one comfort station (2007), a 2-mile walking trail (2008), a playground (2008), and an office and entry building (2009). During construction of the baseball and soccer fields, more than 990,000 cubic feet (ft<sup>3</sup>) of soil was brought onto the complex. Soil was acquired from and transported by Noll Construction. The baseball infields were built with a 60/40 mix of sand/silt and clay to accord with

University of Missouri recommendations. The outfields were topped with an 80/20 mix of sand and peat, received from the St. Charles Sand Company. In 2012, two infields (Fields 8 and 11) were amended with mined “Granitestone” aggregate from Ironton, Missouri.

Stormwater exits the complex via a combination of storm drains, one detention pond, and surrounding retention swales (Bell 2014).

### 3.0 FIELD ACTIVITIES

Field activities for the Pre-CERCLIS Screening at BMAC occurred from May 19 to 23, 2014. START team members included Colin Willits, Danny O'Connor, and Tom Binz. EPA personnel included Region 7 OSCs Todd Campbell and Tom Mahler, and Region 5 personnel Brian Cooper and Jim Mitchell. Photographic documentation of field activities is in Appendix B. Field activities were documented by START in the site logbook (see Appendix C).

#### 3.1 SURFACE SOIL GAMMA SURVEY

From May 20 to 22, 2014, EPA and START field personnel conducted a survey of gross gamma activity over exterior areas of BMAC. In addition, two aforementioned reference areas were surveyed from May 19 to 21, 2014, to provide comparative data. The survey data were generated using a Ludlum Model 2221 ratemeter with a Ludlum Model 44-20 sodium iodide (NaI) scintillation detector, coupled with a GPS unit and notebook computer running Field Analysis and Sampling Tool (FAST) software. FAST is a software program developed by the EPA Region 5 Field Environmental Decision Support (FIELDS) Team that integrates real-time data from GPS receivers and environmental monitoring devices. FAST stores the measurement data with their respective GPS locations in a file, and plots the results in a dynamic, two-dimensional display in real time. To conduct the survey, the surveyor walked in a forward direction at 1 to 2 feet per second along transects spaced approximately 3 meters apart to ensure adequate site coverage. The detector was held at a consistent 6 inches above ground surface. Due to natural variance in radiation levels, the gross gamma survey was split into three surface types: grass-covered areas, exposed soil areas, and improved surfaces (see Appendix A, Figure 3). A total of 58,716 data points were acquired by three survey teams across the BMAC site. To ensure proper functioning of radiation detection instrumentation, a twice-daily (prior to and after field work) source check was performed by use of a cesium-137 check source. No abnormal variations in detector readings, indicating an instrument "drifting" out of calibration, were documented. A detailed discussion of data processing and survey results follows.

##### Normalization of Survey Data

The gross gamma survey was conducted by three teams with identical survey setups. Because of small differences in settings, conditions, and use of the Ludlum detectors, output readings varied among the three teams. In order to compare survey data between teams normalization was required. SAS<sup>®</sup> statistical software was used to perform an analysis of variance (ANOVA) to compare survey results from the three teams. Although differences between the gamma values acquired by each of the teams were small, those

differences were statistically significant due to very low standard deviation values—indicating need to determine a multiplier to render each team’s gamma survey values equivalent.

The multiplier was determined based on the team that consistently had the highest gamma values (Team 1). Koch Park survey data were used for the exposed soil areas, and Blanchette Park survey data were used for grass-covered areas due to their respective similarities to BMAC. For Team 2, in exposed soil, the multiplier was 1.056. This value was calculated by dividing Team 1 Koch Park exposed soil’s median gamma value by Team 2’s median value. All exposed soil gamma values acquired by Team 2 were multiplied by 1.056 to become equivalent to Team 1 for exposed soil. For Team 3, the multiplier was 1.377 for exposed soil.

In grass-covered areas, the multiplier for Team 2 was 1.049, and was 1.464 for Team 3. For Team 2, each gamma value was multiplied by 1.049; for Team 3, each gamma value was multiplied by 1.464.

Application of these multipliers rendered those values equivalent to Team 1’s gamma values.

### **Grass-Covered Areas**

EPA and START personnel surveyed grass-covered areas at BMAC to assess gross gamma activity. During the survey, 38,392 data points were acquired within grass-covered areas. To provide comparative data, grass-covered areas were surveyed at two reference locations (Koch Park and Blanchette Park). The survey of Koch Park included acquisition of 1,871 data points within grass-covered areas. The survey of Blanchette Park included acquisition of 687 data points within grass-covered areas. Table 1 summarizes grass-covered area survey data acquired from BMAC and the reference areas.

**TABLE 1**

### **SUMMARY OF GRASS-COVERED AREA GROSS GAMMA SURVEY RESULTS**

Location	Surface Type	Detector Reading Summary (cpm)				
		Low	High	Median	Mean	Standard Deviation
BMAC	Grass-Covered	10,105	30,300	22,884	22,444	2,633
Koch Park	Grass-Covered	20,163	26,235	23,464	23,377	916
Blanchette Park	Grass-Covered	20,720	24,600	22,824	22,809	699

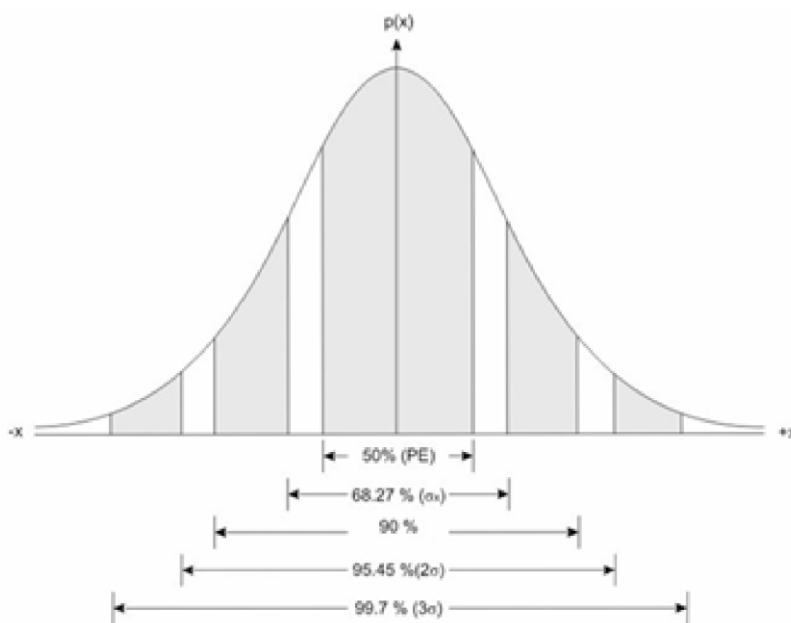
Notes:

BMAC    Bridgeton Municipal Athletic Complex  
cpm      Counts per minute

Large differences between the mean and median would indicate skewness in the data. The difference between the mean and median of BMAC survey data within grass-covered areas is a small fraction (16.7%) of the standard deviation. Moreover, median and mean values from BMAC and reference areas are similar in range. In addition, no readings acquired within grass-covered areas of BMAC were above twice the mean, a level at which EPA Region 7 typically conducts further investigation.

Survey data from grass-covered areas are displayed on Figure 4 in Appendix A. Survey data are depicted as above or below three standard deviations (three-sigma) of the mean value. Standard deviation ( $\sigma$ , sigma) represents the spread of the data about the mean. The mean and standard deviation from grass-covered areas of Blanchette Park were used to determine the three-sigma level. A graphical representation of the distribution of data from grass-covered areas of BMAC is shown in the histograms below. In addition, Histogram 1 depicts data frequency of a normal distribution. An explanation of BMAC data frequency follows.

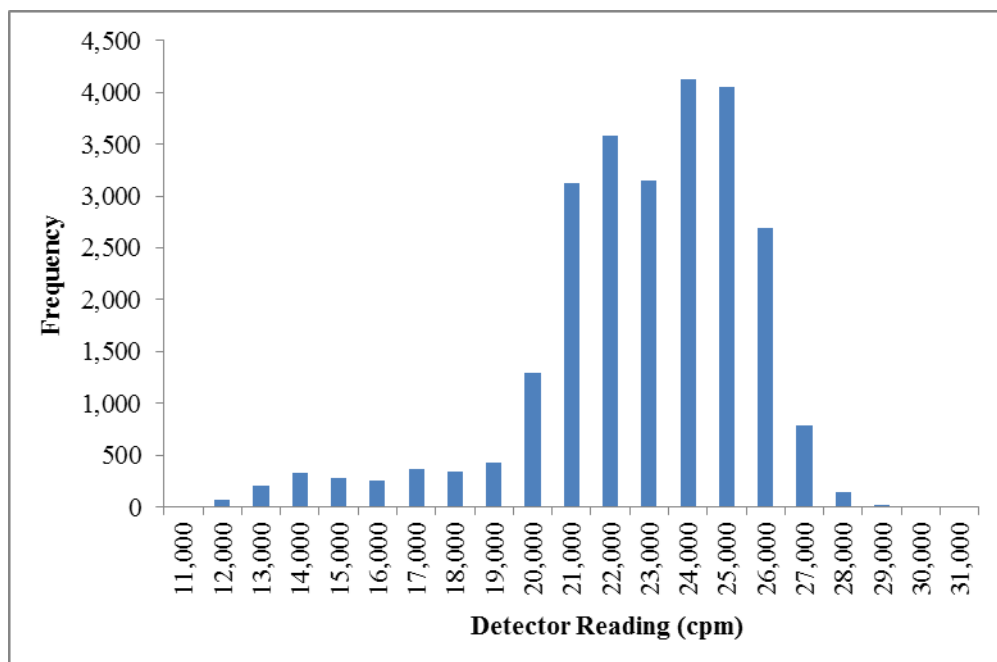
**HISTOGRAM 1**  
**DATA FREQUENCY IN A NORMAL DISTRIBUTION**



Histogram 1 shows data frequency in a normal distribution meeting criteria for the three sigma rule. The three-sigma rule or empirical rule, states that greater than 99% of values lie within three standard deviations of the mean in a normal distribution.

## HISTOGRAM 2

### DISTRIBUTION OF DATA ACROSS NORTHERN PARK AREAS



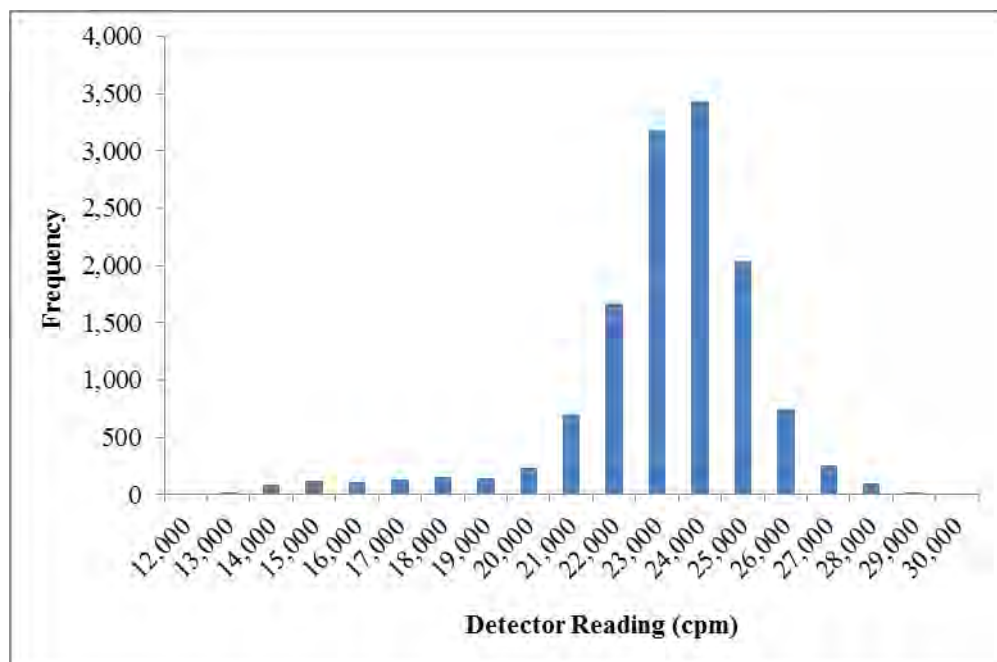
Notes:

cpm      Counts per minute

Histogram 2 displays data frequency from northern park areas (see Appendix A, Figure 2). Survey data collected in these areas indicate two distinct peaks in data frequency. The separate peaks likely indicate a variation in soil type, possibly due to fill material brought on site during the 10-year expansion of BMAC (see Section 2.2). Survey data from northern park areas do not meet criteria for data frequency in a normal distribution. However, geographic plots of the data reveal natural differences in gamma activity exhibited by different soil types, or surface materials. No unusual patterns of concentrated discrete areas of elevated gross gamma activity were observed. The greater frequency of readings below both peaks as compared to readings above the peaks likely indicates a cross-over in data collection between surface types (i.e., readings collected from improved surfaces but labeled as grass-cover data).

### HISTOGRAM 3

#### DISTRIBUTION OF DATA ACROSS SOUTHERN PARK AREAS



Notes:

cpm      Counts per minute

Histogram 3 displays data frequency from southern park areas (see Appendix A, Figure 2). A majority of soil in these areas is believed to be native to the region (see Section 2.2). The greater frequency of readings below the highest frequency peak as compared to readings above the peak likely indicates a cross-over in data collection between surface types (i.e., readings collected from improved surfaces but labeled as grass-cover data). Due to the cross-over in data collection, criteria of a normal distribution are not met for southern park areas. However, geographic plots of the data reveal natural differences in gamma activity exhibited by different soil types, or surface materials. No unusual patterns of concentrated discrete areas of elevated gross gamma activity were observed.

#### Exposed Soil Areas

EPA and START personnel surveyed exposed soil areas at BMAC to assess gross gamma activity. During the survey, 2,795 data points were acquired from exposed soil areas. To provide comparative data, exposed soil areas were surveyed at two reference locations (Koch Park and Blanchette Park). The survey of Koch Park included acquisition of 857 data points from exposed soil areas. The survey of



Blanchette Park included acquisition of 646 data points from exposed soil areas. Table 2 summarizes exposed soil survey data acquired from BMAC and the reference areas.

**TABLE 2**  
**SUMMARY OF EXPOSED SOIL AREA GROSS GAMMA SURVEY RESULTS**

Location	Surface Type	Detector Reading Summary (cpm)				
		Low	High	Median	Mean	Standard Deviation
BMAC	Exposed soil	11,484	29,798	22,338	22,187	2,750
Koch Park	Exposed soil	23,790	28,179	25,611	25,769	850
Blanchette Park	Exposed soil	19,896	24,256	22,248	22,219	873

Notes:

BMAC    Bridgeton Municipal Athletic Complex  
cpm      Counts per minute

The difference between the mean and median of BMAC survey data over exposed soil areas is a small fraction (5.5%) of the standard deviation. Moreover, median and mean values from BMAC and reference areas are similar in range. In addition, no readings acquired within exposed soil areas of BMAC were above twice the mean, a level at which EPA Region 7 typically conducts further investigation. Survey data on the low and high range may represent a cross-over in data collection between surface types (i.e., readings collected from improved surfaces but labeled as exposed soil data).

Graphical data review, consisting of mapping survey data, can potentially reveal heterogeneities over the survey area (EPA 2000). Geographic plots of the data reveal natural differences in gamma activity exhibited by different soil types, or surface materials. Application of “Granitestone” aggregate to fields 8 and 11 in 2012, may account for variability in survey data from exposed soil areas. No unusual patterns of concentrated discrete areas of elevated gross gamma activity were observed. Survey data from exposed soil areas are displayed on Figure 5 in Appendix A.

### **Improved Surfaces**

EPA and START personnel surveyed improved surfaces (i.e., concrete and asphalt) at BMAC to assess gross gamma activity. During the survey, 17,529 data points were acquired from improved surfaces. Improved surfaces were not surveyed at reference areas. Table 3 summarizes improved surface survey data from BMAC.

TABLE 3

## SUMMARY OF IMPROVED SURFACE GROSS GAMMA SURVEY RESULTS

Location	Surface Type	Detector Reading Summary (cpm)				
		Low	High	Median	Mean	Standard Deviation
BMAC	Improved	9,898	28,945	14,924	15,996	3,276

Notes:

BMAC    Bridgeton Municipal Athletic Complex  
cpm      Counts per minute

The difference between the mean and median of BMAC survey data over improved surfaces is a small fraction (33%) of the standard deviation. In addition, no readings acquired within improved surfaces of BMAC were above twice the mean, a level at which EPA Region 7 typically conducts further investigation. Survey data on the low and high range may represent a cross-over in data collection between surface types (i.e., readings collected from grass-covered areas but labeled as improved surface data).

Geographic plots of the data reveal natural differences in gamma activity exhibited by different surface materials. No unusual patterns of concentrated discrete areas of elevated gross gamma activity were observed. Survey data from improved surfaces are displayed on Figure 6 in Appendix A.

### 3.2 SOIL SAMPLING

From May 21 to 23, 2014, EPA and START personnel collected 112 soil samples. Eighty-eight surface soil samples (0 to 2 inches below ground surface [bgs]) were collected at BMAC. The samples included the following: 30 composite samples collected within grass-covered areas, 30 composite samples collected within exposed soil areas, 17 discrete samples collected within drainage areas, and 11 samples collocated with samples previously collected by a community group. In addition, 24 samples were collected within the two reference areas—Koch Park and Blanchette Park. Soil sampling locations at the two reference parks are depicted on Figure 7 in Appendix A. Soil sampling locations at BMAC are depicted on Figure 8 in Appendix A.

Soil samples were delivered to TestAmerica Laboratories, Inc., in Earth City, Missouri, for analysis. Soil samples will be analyzed for isotopic uranium, isotopic thorium, radium-226, and other naturally occurring radionuclides. Laboratory analysis of soil samples will accord with Section 2.5 and Table 4 of the Quality Assurance Project Plan (Tetra Tech 2014). The soil sample results will be reported in a final

Pre-CERCLIS Screening report, to be completed in July 2014. The final Pre-CERCLIS Screening report will include the following:

- A description of the methodology and protocol for soil sampling implemented during field activities;
- Analytical data resulting from analysis of soil samples for radionuclides;
- A comparison of the laboratory-reported radionuclide concentrations in soil to applicable health-based standards;
- A completed Region 7 Superfund Site Pre-CERCLIS Screening Form addressing if further assessment is warranted.

#### 4.0 SUMMARY

Tetra Tech START was tasked by EPA Region 7 to assist with Pre-CERCLIS screening at BMAC in Bridgeton, Missouri. The site is at 13161 Taussig Road and consists of 11 baseball fields, four tennis courts, a playground area, a handball/racquetball court, a soccer field, multiple walking trails, two large parking lots, multiple concession buildings, an operation center, and various structures. The screening activity is in response to a request by the Missouri Attorney General to the EPA Regional Administrator to assess radiation levels in soil at the Park.

Field work occurred from May 19 to 23, 2014. Activities addressed in this Preliminary Pre-CERCLIS Screening report include assessment of real-time gross gamma data collected over exterior surface areas of BMAC and two reference areas, Koch Park and Blanchette Park. During the survey of BMAC, 58,716 data points were acquired from surfaces of three types (grass-covered areas, exposed soil areas, and improved surfaces). No survey data acquired within BMAC were above twice the mean, a level at which EPA Region 7 typically conducts further investigation. In addition, geographic plots of the data reveal natural differences in gamma activity exhibited by different soil types, or surface materials. No unusual patterns of concentrated discrete areas of elevated gross gamma activity were observed. To obtain comparative reference data, field personnel surveyed grass-covered and exposed soil areas of Koch and Blanchette Parks. Detector readings from reference areas show variability similar to that exhibited by data acquired from BMAC. Further CERCLA assessment does not appear warranted based on results from the gross gamma survey of BMAC; however, analytical data review will be required before making a definitive conclusion.

Upon completion of the real-time gross gamma survey at BMAC and reference areas, soil samples were collected and submitted to TestAmerica Laboratories in Earth City, Missouri, for analysis for radionuclide concentrations. Although gross gamma data are valuable for assessing site radioactivity, complementary soil sampling will quantify concentrations of both gamma emitting and non-gamma emitting radionuclides, including those raised as a concern by the public. When received, the laboratory-reported radionuclide soil concentrations will be used in concert with gross gamma survey data to determine exposure risk and whether further response is warranted. The final Pre-CERCLIS Screening report, to be completed in July 2014, will include the following:

- A description of the methodology and protocol for soil sampling implemented during field activities;
- Analytical data resulting from analysis of soil samples for radionuclides;

- A comparison of the laboratory-reported radionuclide concentrations in soil to applicable health-based standards;
- A completed Region 7 Superfund Site Pre-CERCLIS Screening Form addressing if further assessment is warranted.

## **5.0 REFERENCES**

Bell, John. 2014. Bridgeton Municipal Athletic Complex (BMAC) Field Condition Summary. June 2.

U.S. Environmental Protection Agency (EPA). 2000. Multi-Agency Radiation Survey and Site Inspection Manual (MARSSIM), Revision 1. EPA 402-R-97-016, Rev. 1. August.

Tetra Tech, Inc. (Tetra Tech). 2014. Quality Assurance Project Plan for a Pre-CERCLIS Screening at the Bridgeton Municipal Athletic Complex site. May 13.

**APPENDIX A**  
**FIGURES**

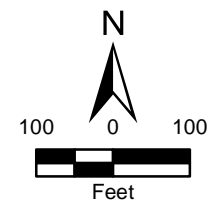








- Legend
- Walking trail - north/south dividing line
  - BMAC boundary
  - Northern park area (new construction)
  - Southern park area (original construction)
  - BAA - Bridgeton Athletic Association



Source: ESRI Imagery Basemap, 2014  
Bridgeton Parks and Recreation, BMAC Map, 2014

Bridgeton Municipal Athletic Complex (BMAC)  
Bridgeton, Missouri

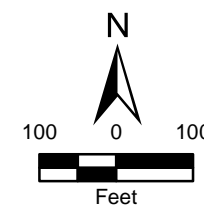
**Figure 2**  
Site Layout Map







- Legend
- BMAC boundary
  - Building / structure
  - Grass-covered area
  - Improved surface
  - Pond
  - Exposed soil area



Source: ESRI Imagery Basemap, 2014

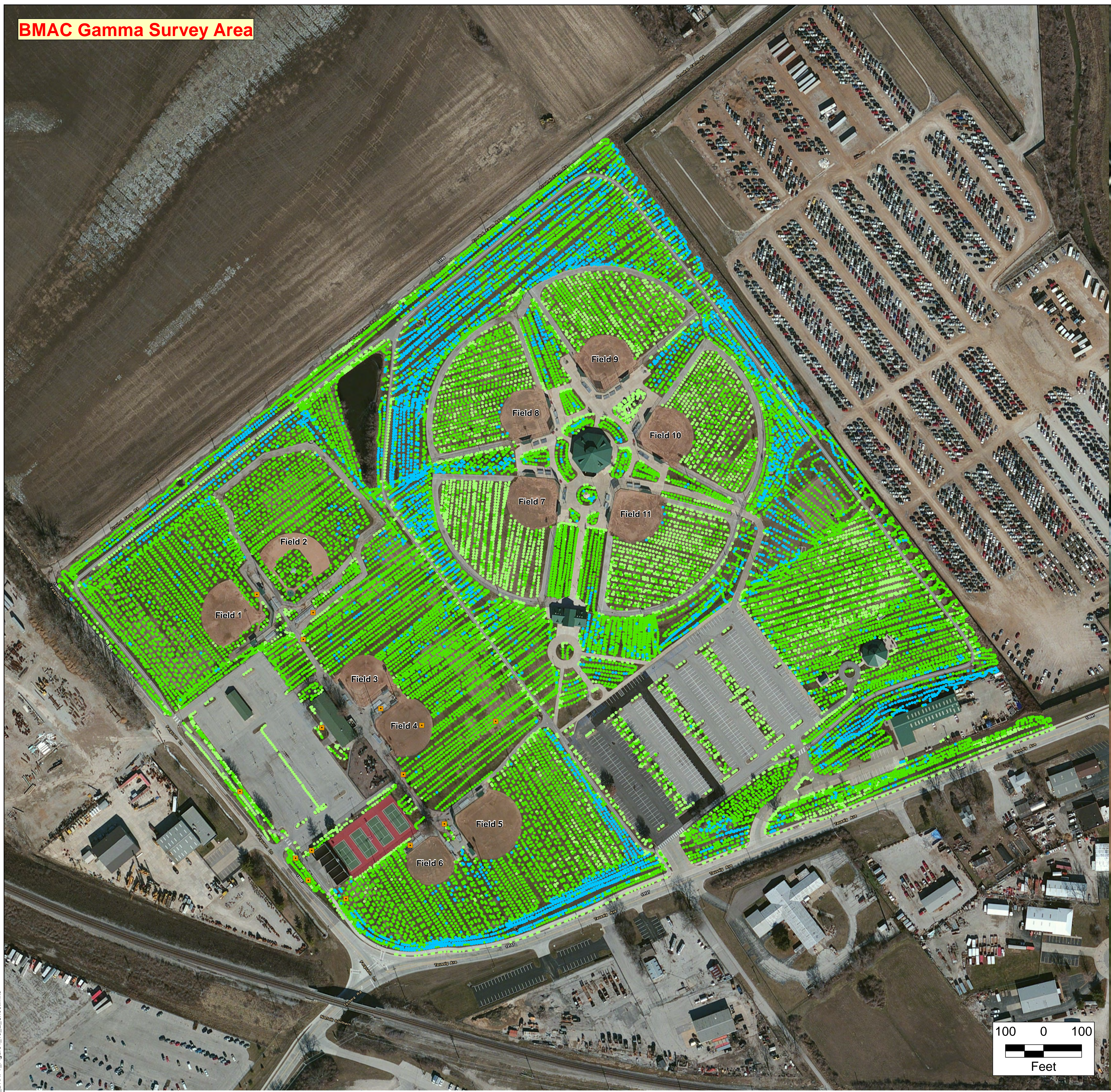
Bridgeton Municipal Athletic Complex (BMAC)  
Bridgeton, Missouri

**Figure 3**  
Site Surface Type Map





BMAC Gamma Survey Area



Koch Park Gamma Survey Area



Blanchette Park Gamma Survey Area



- Legend
- cpm < 3 Sigma
  - cpm From <3 Sigma to > 3 Sigma
  - cpm > 3 Sigma
  - cpm > 2 X Background
  - Concerned citizens soil sample location
- cpm counts per minute  
sigma standard deviation + mean

Note: The survey data were generated using a Ludlum Model 2221 ratemeter with a Ludlum Model 44-20 sodium iodide (NaI) scintillation detector, coupled with a GPS unit and notebook computer running Field Analysis and Sampling Tool (FAST) software.



Bridgeton Municipal Athletic Complex (BMAC)  
Bridgeton, Missouri

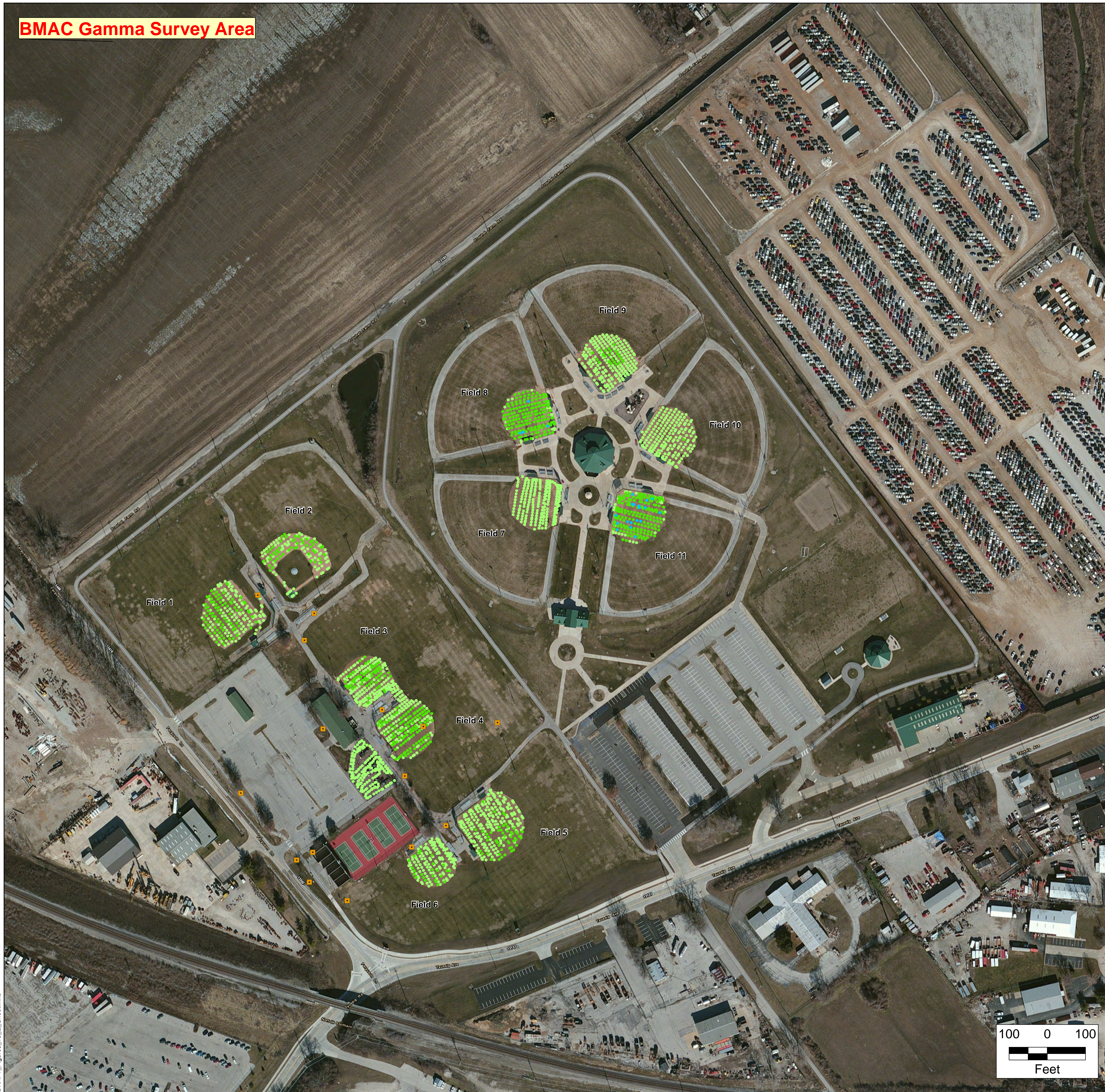
**Figure 4**  
Gross Gamma Survey Results From  
Grass Covered Areas



Date: 6/24/2014 Drawn By: Colin Willis Project No: 103X902514.0002.023



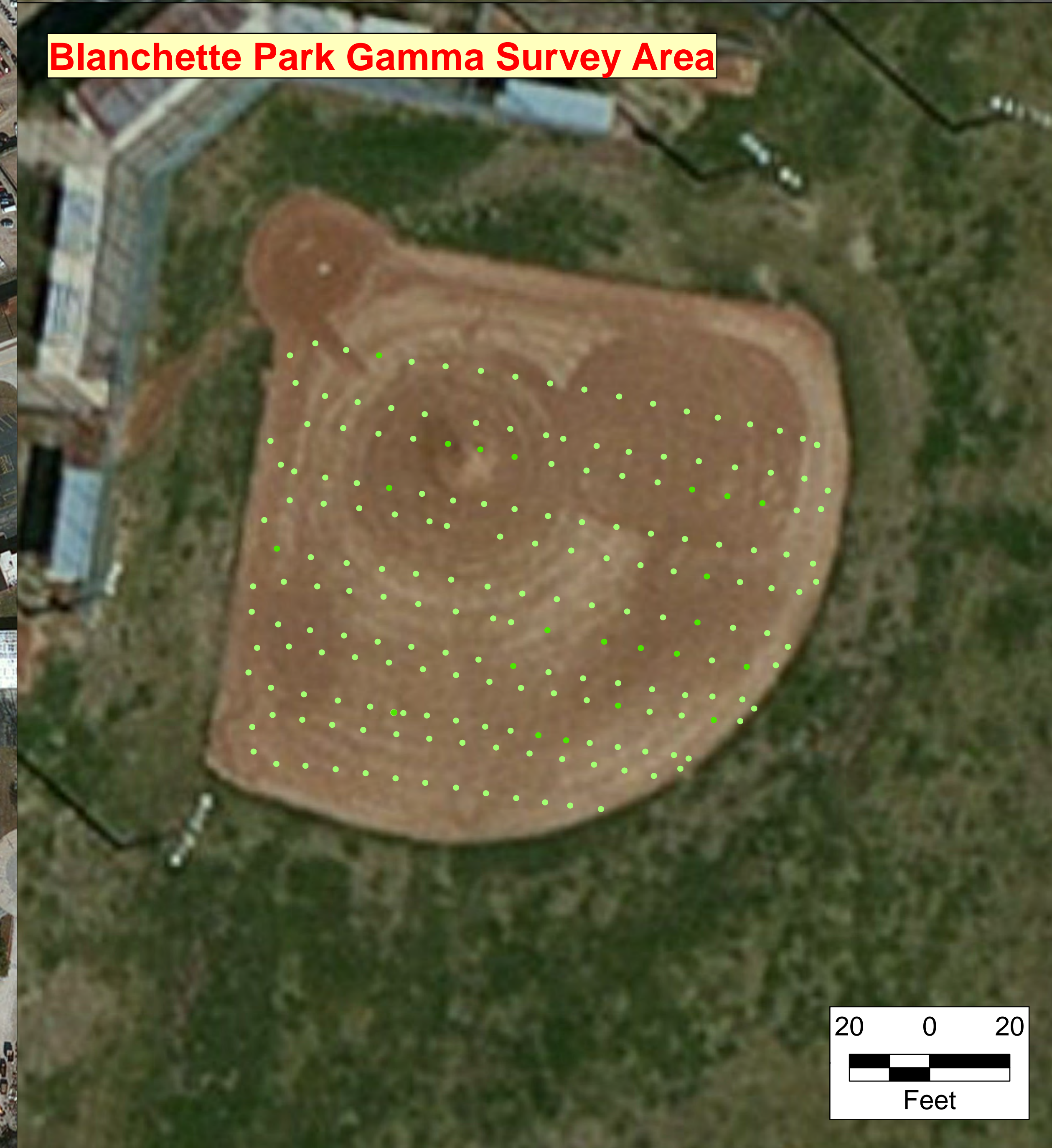
BMAC Gamma Survey Area



Koch Park Gamma Survey Area



Blanchette Park Gamma Survey Area



Legend

- cpm < 3 Sigma
- cpm From <3 Sigma to > 3 Sigma
- cpm > 3 Sigma
- cpm > 2 X Background
- Concerned citizens soil sample location
- cpm counts per minute
- sigma standard deviation + mean

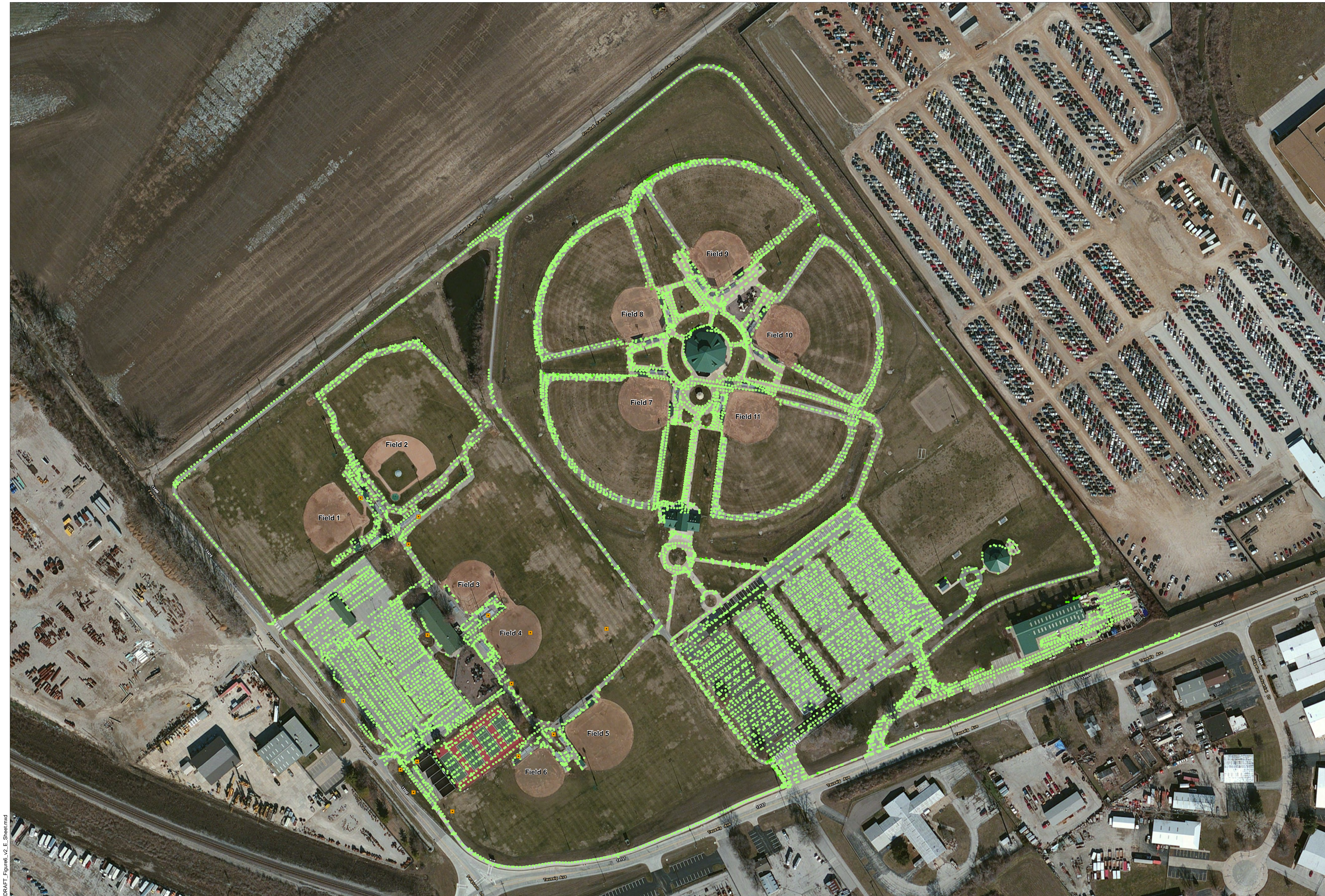
Note: The survey data were generated using a Ludlum Model 2221 ratemeter with a Ludlum Model 44-20 sodium iodide (NaI) scintillation detector, coupled with a GPS unit and notebook computer running Field Analysis and Sampling Tool (FAST) software.



Bridgeton Municipal Athletic Complex (BMAC)  
Bridgeton, Missouri

**Figure 5**  
Gross Gamma Survey Results From  
Exposed Soil Areas





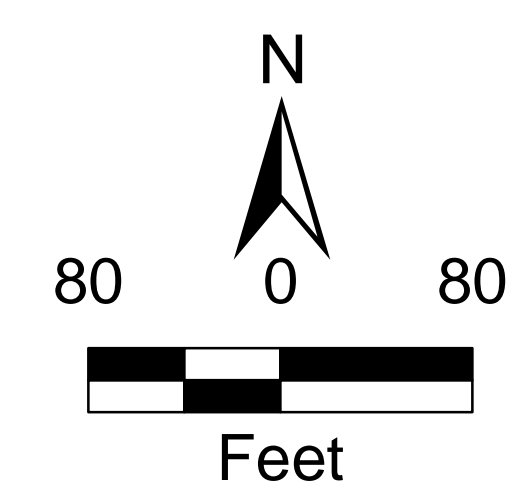
C:\GIS\0251002\023\Projects\mxd\Tip\_Report\_DRAFT\_Figures\_v2\_E\_Sheet.mxd

Source: ESRI Imagery Basemap, 2014

### Legend


- cpm < 3 Sigma
  - cpm From <3 Sigma to > 3 Sigma
  - cpm > 3 Sigma
  - cpm > 2 X Background
  - Concerned citizens soil sample location
- cpm counts per minute  
sigma standard deviation + mean

Note: The survey data were generated using a Ludlum Model 2221 ratemeter with a Ludlum Model 44-20 sodium iodide (NaI) scintillation detector, coupled with a GPS unit and notebook computer running Field Analysis and Sampling Tool (FAST) software.



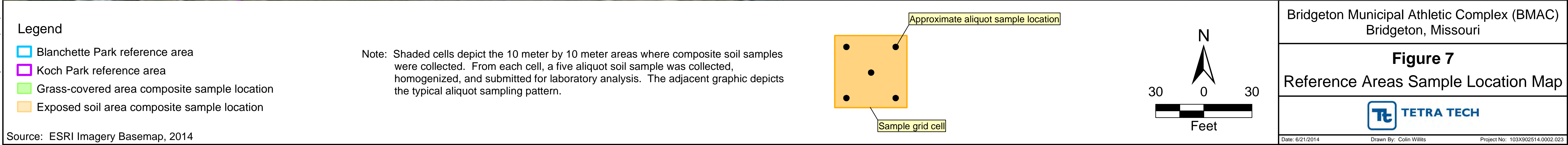
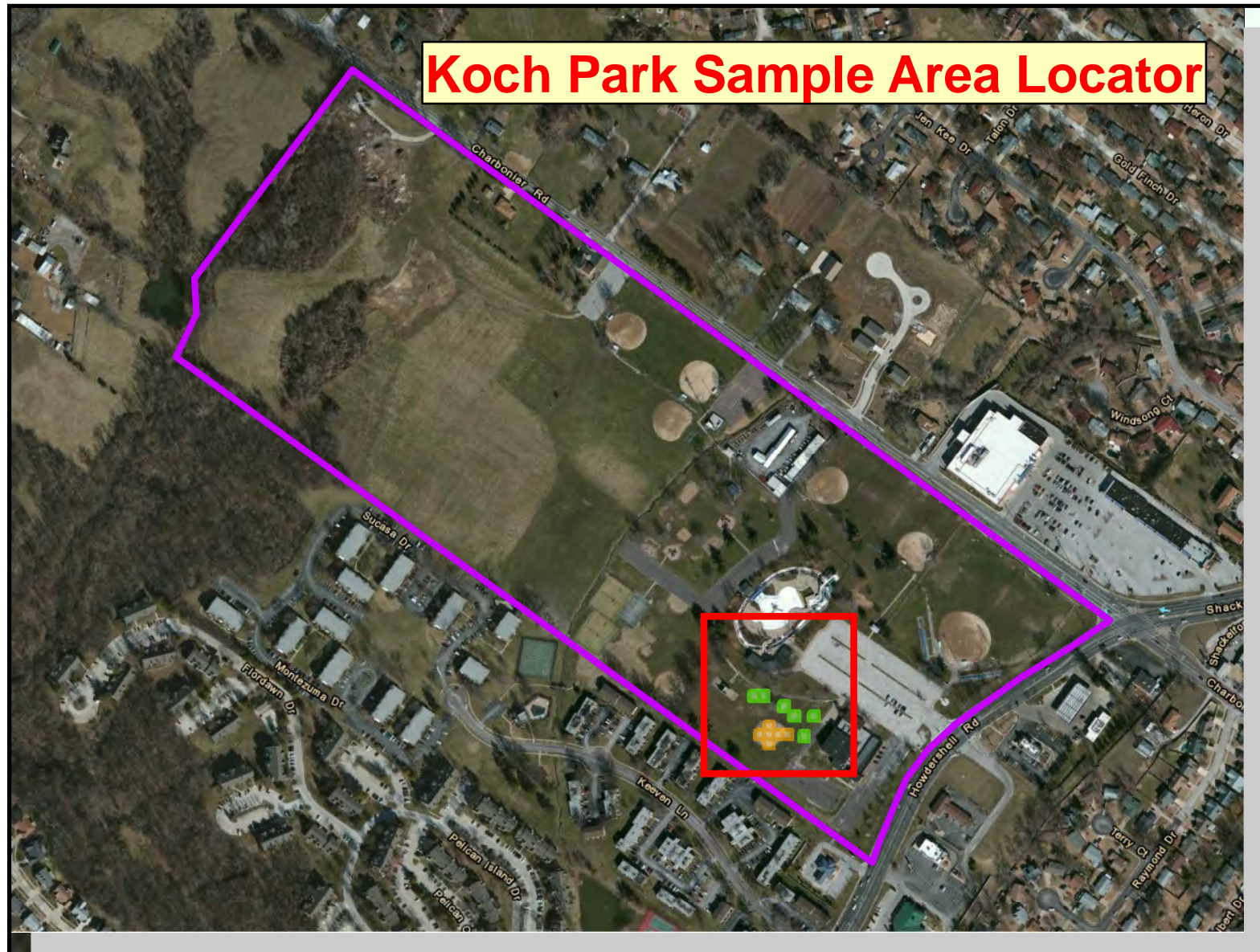
Bridgeton Municipal Athletic Complex (BMAC)  
Bridgeton, Missouri

**Figure 6**  
Gross Gamma Survey Results From  
Improved Surfaces

 TETRA TECH

Date: 6/24/2014 Drawn By: Colin Willis Project No: 103X902514.0002.023



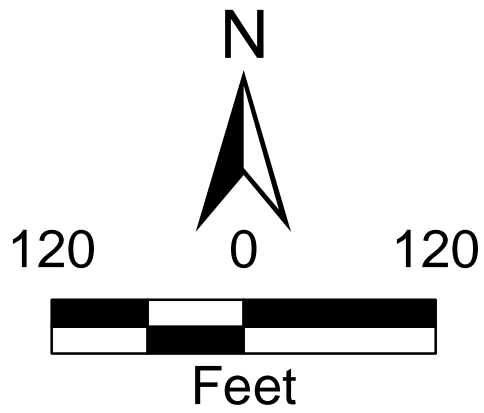
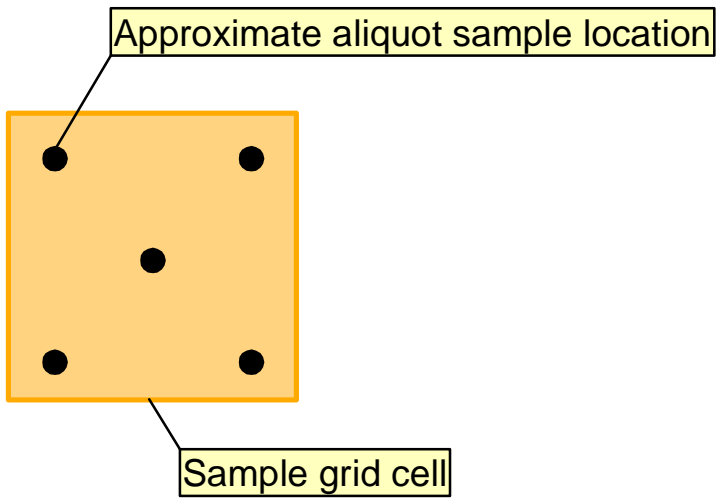






- Legend
- Discrete soil sample location
  - Outfall sample location
  - Drainage ditch
  - BMAC boundary
  - Grass-covered area composite sample location
  - Exposed soil area composite sample location

Note: Shaded cells depict the 10 meter by 10 meter areas where composite soil samples were collected. From each cell, a five aliquot soil sample was collected, homogenized, and submitted for laboratory analysis. The adjacent graphic depicts the typical aliquot sampling pattern.



Source: ESRI Imagery Basemap, 2014  
Bridgeton Municipal Athletic Complex (BMAC)  
Bridgeton, Missouri

**Figure 8**  
BMAC Sample Location Map





**APPENDIX B**  
**PHOTOGRAPHIC DOCUMENTATION**



**Pre-CERCLIS Screening at the Bridgeton Municipal Athletic Complex  
Bridgeton, Missouri**



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: North	DESCRIPTION	This photograph shows the entrance sign at the Bridgeton Municipal Athletic Complex (BMAC).	1
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Colin Willits	5/23/2014



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: North	DESCRIPTION	This photograph shows the BMAC entry building.	2
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Danny O'Connor	5/23/2014

**Pre-CERCLIS Screening at the Bridgeton Municipal Athletic Complex  
Bridgeton, Missouri**



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: Northwest	DESCRIPTION	This photograph shows the southwest portion of BMAC looking northwest.	3
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Colin Willits	5/23/2014



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: North	DESCRIPTION	This photograph shows the southwest parking lot.	4
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Colin Willits	5/23/2014

**Pre-CERCLIS Screening at the Bridgeton Municipal Athletic Complex  
Bridgeton, Missouri**



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: NA	DESCRIPTION	This photograph shows a source check of radiation detection equipment prior to field use. A cesium-137 check source was screened prior to and after field work each day.	5
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Colin Willits	5/20/2014



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: East	DESCRIPTION	This photograph shows a gross gamma survey setup. Survey data were generated using a Ludlum Model 2221 ratemeter with a Ludlum Model 44-20 sodium iodide (NaI) scintillation detector, coupled with a Global Positioning System (GPS) unit and notebook computer running Field Analysis and Sampling Tool (FAST) software.	6
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Danny O'Connor	5/19/2014



**Pre-CERCLIS Screening at the Bridgeton Municipal Athletic Complex  
Bridgeton, Missouri**



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: North	DESCRIPTION	This photograph shows field personnel conducting a gross gamma survey near the southeast BMAC parking lot.	7
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Danny O'Connor	5/21/14



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: North	DESCRIPTION	This photograph shows field personnel conducting a gross gamma survey over an improved surface (concrete) at BMAC.	8
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Danny O'Connor	5/20/2014

**Pre-CERCLIS Screening at the Bridgeton Municipal Athletic Complex  
Bridgeton, Missouri**



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: East	DESCRIPTION	This photograph shows a baseball field at Blanchette Park where reference data were acquired.	9
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Danny O'Connor	5/21/2014



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: North	DESCRIPTION	This photograph shows the three gross gamma survey setups used to conduct the gross gamma survey at BMAC and the reference areas.	10
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Colin Willits	5/21/2014



**Pre-CERCLIS Screening at the Bridgeton Municipal Athletic Complex  
Bridgeton, Missouri**



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: Northwest	DESCRIPTION	This photograph shows three teams acquiring gross gamma survey data at grass-covered areas at Blanchette Park.	11
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Colin Willits	5/21/2014



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: South	DESCRIPTION	This photograph shows three teams acquiring gross gamma survey data at areas of exposed soil at Blanchette Park.	12
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Colin Willits	5/21/2014

**Pre-CERCLIS Screening at the Bridgeton Municipal Athletic Complex  
Bridgeton, Missouri**



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: Southeast	DESCRIPTION	This photograph shows an area of exposed soil at Koch Park where reference data were acquired.	13
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Colin Willits	5/19/2014



TETRA TECH PROJECT NO. 103X9025140002.023  Direction: Northeast	DESCRIPTION	This photograph shows three teams acquiring gross gamma survey data at areas of exposed soil at Koch Park.	14
	CLIENT	U.S. Environmental Protection Agency Region 7	Date
	PHOTOGRAPHER	Colin Willits	5/19/2014

**APPENDIX C**  
**SITE LOGBOOK**



5-19-14 BMAC Pre-CERCLIS Screening

0745 STMs Danny O'Connor & Colin Willits  
load rental vehicle and depart  
for site

1230 Arrive @ site. STM Tom Benz on site  
- Meet with Bridgeton, MO officials to  
discuss site uses

- Provided map of site

- South side of park built in mid 70s

- Major expansion 99-02 to add north  
fields

- Parks crew will write up summary  
of site history

Meet with EPA Campbell and local  
citizen that collected samples from BMAC

(Dawn Chapman)

- City Councilman

Randy Hein, Donna, Daken, + Coach

Discuss site activities

Concerned citizens concerned about background  
concentrations

- Want samples taken outside West  
Lake Area - Cliff Cave Park suggested  
for background

- Want EPA to contact FUSRAP

- EPA Mahler discussing screening

5-19-14 BMAC Pre-CERCLIS screening

process of surface soils

- Concerned about Thorium-230

38.77836, -90.43125

38.77830, -90.43129

Both drainage ditches - Sampling locations

11 total samples collected by  
citizens

Field #1 between home and 3rd

Grassy area

Total Gamma 190 Bq/ml  $\rightarrow$  5.13 pCi/g

Bridgeton Parks official

1740 Arrive @ Koch Park in Florissant, MO  
to collect background readings

Run all three Fast System setups

over grass areas and infield dirt.

No readings collected from ditch.

1915 Complete background screening

1950 Arrive back @ West Lake Field trailer

2045 Depart site. End day

Danny O.  
5-19-14



## 5-20-14 BMAC Pre-CERCLIS Screening

0600 STMs O'Connor and Willits arrive on site. STM Benz on site

Weather: Sunny mid to upper 80s

- Will complete surface scan of soils

@ Koch Park then move to BMAC to begin surface soil scanning of gross gamma radiation with Ludlum 2221 ratemeter with 44-20 detector

0713 Arrive @ Koch Park. Complete background survey of grass & dirt

0839 Arrive @ BMAC. STMs O'Connor & Willits work as Team 3 on gross gamma survey

1200 Lunch

1243 Continue FAST survey of north areas

1852 Drop off equipment @ West Lake office trailer

1910 STMs depart site. End day

5-20-14  
Danny O.

## 5-21-14 BMAC Pre-CERCLIS screening

0700 STMs O'Connor & Willits arrive @ West Lake Field Trailer. STM Benz on site.

Weather: Sunny & hot. High 91°F, 30%.

chance of afternoon storms

- Will collect reference area data from Blanchet park and continue surface soil assessment of BMAC

0745 Arrive @ Blanchette Park

- Collect reference gross gamma readings using FAST

0929 Arrive @ BMAC, begin FAST survey

1200 Lunch

1249 STM O'Connor arrives in southwest parking lot to collect discrete soil samples from same location as Bridgeton citizens

1259 BMAC - Discrete - 1  
38.77782, -90.43053

1310 BMAC - Discrete - 3  
38.77777, -90.43070

1325 BMAC - Discrete - 4  
38.77824, -90.43130

1335 BMAC - Discrete - 2  
38.77868, -90.43040



5-21-14 BMAC Pre-CERCLIS Screening

1355 BMAC-Discrete-10

38.77963, -90.43098

1400 BMAC-Discrete-9

38.77953, -90.43041

1420 BMAC-Discrete-8

38.77936, -90.43054

1435 BMAC-Discrete-~~5~~<sup>4</sup> 00

38.77835, -90.42966

1448 BMAC-Discrete-5

38.77779, -90.42970

1455 BMAC-Discrete-6

38.77790, -90.42923

1501 BMAC-Discrete-7

38.77872, -90.42991

1520 Prep COC, Rain delay in survey

STM Willits and O'Connor continue

surface soil scan on steep slope

on southeast hill along

- Readings consistently above background

(18-21 Kcpm). Check area already

surveyed, readings similar to southeast

hill. Rain may have caused elevated

readings - Radon concentrated by rain

1820 STMs Willits, O'Connor, and Benz depart

Danny O.

5-21-14

5-22-14 BMAC Pre-CERCLIS Screening

0720 STMs O'Connor & Willits arrive on site. STM Benz on site.

Weather: 82°F with 30% chance of afternoon storms

- Planned activities include Finishing FAST survey and sampling @ reference areas and BMAC

0800 STM O'Connor, EPA Mahler, & EPA Campbell work to finish FAST survey of southeast hillside

0920 All FAST survey for Team 3 is complete. STM Benz continues FAST survey in central area of complex

1030 STM O'Connor and EPA Mahler depart for Koch park

1048 Arrive @ Koch Park, prep to collect dirt and grass samples

1054 Collect Koch-Soil-1

1102 Collect Koch-Soil-2

1105 Collect Koch-Soil-3

1109 Collect Koch-Soil-4

1114 Collect Koch-Soil-5

1118 Collect Koch-Soil-6

1123 Collect Koch-<sup>Grass</sup>~~Soil~~-1  
D.O.

Rite in the Rain.



5-22-14 BMAC Pre-CERCLIS Screening

1130 Collect Koch-Grass-2

1135 Collect Koch-Grass-3

1141 Collect Koch-Grass-4

1147 Collect Koch-Grass-5

1150 Collect Koch-Grass-6

Use Victoreen Model 451 Ion-chamber  
to collect dose readings

-Check with 5 $\mu$ Ci Cs-137 (4.5  $\mu$ Sv/hr)  
reads 4.6  $\mu$ Sv/hr

Readings:

0.08

0.8 - 0.13  $\mu$ Sv/hr

0.0

38.80781, -90.36276

0.09 - 0.15  $\mu$ Sv/hr

38.80777, -90.36280

0.07 - 0.16  $\mu$ Sv/hr

38.80779, -90.36240

1225 Arrive back @ BMAC

Complete COC

-STM Willits working on Arcpad application  
for soil sampling @ BMAC and  
Blanchette Park

1320 Arrive @ Blanchette Park

1331 Collect Blanchette-Soil-1

1340 Collect Blanchette-Soil-2

5-22-14 BMAC Pre-CERCLIS Screening

1345 Collect Blanchette-Soil-3

1350 Collect Blanchette-Soil-4

1355 Collect Blanchette-Soil-5

1400 Collect Blanchette-Soil-6

1408 Collect Blanchette-Grass-1

1415 Collect Blanchette-Grass-2

1425 Collect Blanchette-Grass-3

<sup>1430</sup>  
~~1435~~ Collect Blanchette-Grass-4

1435 Collect Blanchette-Grass-5

1445 Collect Blanchette-Grass-6

1507 Collect dose reading Blanchette Park  
Victoreen Model 451 05-RAD 451P-A

• 0.09  $\mu$ Sv/hr to 0.14  $\mu$ Sv/hr

GPS 38.79867 N x 90.48353 W

• 0.07  $\mu$ Sv/hr to 0.15  $\mu$ Sv/hr

GPS 38.79852 N x 90.48325 W

1525 Arrive back @ BMAC. Finish COCs

1605 Test America picks up samples

1700 STM O'Connor departs site

1730 STM Willits departs site

Danny O.  
5-22-14



## 5-23-14 BMAC Pre-CERCLIS Screening

0657 STM O'Connor &amp; Willits arrive on site.

STM Binz already on site

Weather: 79°F &amp; Sunny

- Will complete surface soil sampling

@ BMAC

STM O'Connor &amp; EPA Campbell begin

sampling as team A

0745 BMAC-Grass-29

0752

0755 BMAC-Grass-30

D.O.

0805 BMAC-Grass-28

0815 BMAC-Soil-30

0825 BMAC-Soil-29

0832 BMAC-Soil-28

0835 BMAC-Soil-27

0840 BMAC-Soil-26

0845 BMAC-~~Soil~~<sup>Grass</sup>-25

0857 BMAC-Grass-24

0903 BMAC-Soil-21

0907 BMAC-Soil-23

0912 BMAC-Soil-22

0918 BMAC-Soil-25. Playground area  
has mulch to > 1' bgs. Will collect  
surface mulch sample

0925 BMAC-Soil-24. Also mulch

## 5-23-14 BMAC Pre-CERCLIS Screening

0932 BMAC-Soil-20

0934 BMAC-Soil-19

0940 BMAC-Grass-20

0947 BMAC-Grass-19

1000 BMAC-Grass-12

1008 BMAC-Soil-15

1023 BMAC-Grass-13

1035 BMAC-Grass-18

1045 BMAC-Grass-22

1100 BMAC-Soil-17

1105 BMAC-Soil-16

1108 BMAC-Soil-18

1150 EPA Campbell & Mahler meet with city  
administrators to give site update- EPA Campbell shares powerpoint  
with group

- 68 acres → more than 60k data points

City Concerns

- July 4<sup>th</sup> - will they have results by  
then?- 21-day ingrowth process explained by  
EPA Mahler

- Waste concentration @ West Lake

- Analysis will look for radionuclides

Rite in the Rain.

5-23-14 BMAC Pre-CERCLIS Screening  
specific to West Lake (Ka-226, Th-230, U-238)

- Explains Gamma scan @ BMAC

correlates with reference areas

EPA maintains position that all  
scientific information indicates BMAC  
is suitable for use

- City wants EPA to release statement

- Prep sampler for lab

1340 Test America picks up samples

STM Willis and O'Connor depart for  
KC, STM Binz leaves site

1750 Arrive in Kansas City. Unload vehicle

1815 End day

Danny O.  
5-23-14



5-23-14 BMAC

BMAC

- STM Willits, STM Bine, and  
Osc Mahler begin sampling  
Team B area

- 0743 collected BMAC-SOIL-11  
- 0747 collected BMAC-SOIL-9  
- 0752 collected BMAC-GRASS-14  
- 0805 collected BMAC-GRASS-16  
- 0817 collected BMAC-SOIL-14  
- 0821 collected BMAC-SOIL-12  
- 0826 collected BMAC-SOIL-10  
- 0829 collected BMAC-SOIL-13  
- 0838 collected BMAC-SOIL-8  
- 0841 collected BMAC-SOIL-7  
- 0844 collected BMAC-GRASS-9  
- 0858 collected BMAC-GRASS-6  
- 0907 collected BMAC-SOIL-1  
~~- 0913 collected BMAC-SOIL-13 CW~~  
0913 collected BMAC-SOIL-3  
0928 collected BMAC-GRASS-8  
0933 collected BMAC-SOIL-5  
0935 collected BMAC-SOIL-4  
0939 collected BMAC-SOIL-6  
~~- 0952 collected BMAC-SOIL-2 CW~~  
0952 collected BMAC-GRASS-23

5-23-14 BMAC

BMAC

- 0950 collected BMAC-GRASS-26  
- 10:03 collected BMAC-GRASS-27  
- 10:10 collected BMAC-GRASS-21  
- 10:14 collected BMAC-GRASS-17  
- 10:20 collected BMAC-GRASS-15  
- 10:30 collected BMAC-GRASS-11  
- 10:38 collected BMAC-GRASS-4  
~~- 10:44 collected BMAC-GRASS-2 CW~~  
- 10:47 collected BMAC-GRASS-3  
- 10:51 collected BMAC-GRASS-2  
- 10:57 collected BMAC-GRASS-1  
- 11:02 collected BMAC-GRASS-5  
- 11:06 collected BMAC-GRASS-7  
- 11:12 collected BMAC-GRASS-10  
- 11:29 collected BMAC-OUTFALL-17  
- 11:33 collected BMAC-OUTFALL-18  
- 11:40 collected BMAC-OUTFALL-16  
- 11:44 collected BMAC-OUTFALL-15  
- 11:49 collected BMAC-OUTFALL-14  
- 12:03 collected BMAC-OUTFALL-10  
encountered non-native material  
in sample BMAC-OUTFALL-10  
~~- 12:12 collected BMAC-OUTFALL-13 CW~~  
12:12 collected BMAC-OUTFALL-11

Rite in the Rain.



5-23-14 BMAC

- 12:24 collected BMAC-OUTFALL-2
- 12:40 collected BMAC-OUTFALL-3
- 12:42 collected BMAC-OUTFALL-4
- 12:47 collected BMAC-OUTFALL-9
- 12:51 collected BMAC-OUTFALL-8
- 12:55 collected BMAC-OUTFALL-7
- 12:59 collected BMAC-OUTFALL-6
- 13:02 collected BMAC-OUTFALL-5
- 13:09 collected BMAC-OUTFALL-19
- 13:11 collected BMAC-OUTFALL-20
- 13:15 sampling complete
- 13:56 demobilize from site

C. Willits  
5-23-14